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(54) DISK DRIVE APPARATUS USING HYDRODYNAMIC BEARING UNIT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a disk drive apparatus with a thrust pivot bearing using macromolecular material in a bearing unit, consisting of the thrust pivot bearing and a radial hydrodynamic bearing.

SOLUTION: Thrust bearing is provided with the following structure. Namely, the tip of a shaft is supported by a metal plate via a resinous thrust material, and worn powder generated by sliding between the tip of the shaft and resin thrust material is managed to be non-metallic, in order to improve its reliability. Conductivity is also given to resin material used for thrust material, and polyacetal resin, having superior lubricating property, is also used for thrust material, or polyimide resin having superior heat resistance is used for the thrust

material.

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

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CLAIMS

[Claim(s)]

[Claim 1] As opposed to a housing body, the sleeve section fixed to this housing, and said housing body relatively The Rota section which can rotate freely, The head concluded by said Rota section to a globular form shaft and said shaft end-face side A bottom plate, Have thrust material between said shafts and bottom plates, and it consists of said shaft and said sleeve section. It is the bearing of the compound die which has the radial hydrodynamic bearing which has a herringbone slot in either, the thrust material put on the bottom plate fixed to one side of said sleeve section, and the thrust pivot bearing which consists of ends of a shaft. Oil is filled up with the sleeve section and a bottom plate into the bearing by which the ****** configuration was carried out. In the disk driving gear which used the hydrodynamic bearing equipment of the compound die of the oil lubrication in which the oil makes generate the dynamic pressure of the bearing of a radial direction, and the sliding section of the bearing of the thrust direction

carries out lubrication Said thrust material intervenes between the spherical point of said shaft, and said bottom plate. The PIPOTTO bearing to which the head of a shaft slides on a thrust material top Nothing, The disk driving gear which used the hydrodynamic bearing equipment of the compound die of the oil lubrication which becomes said bottom plate of the surra SUTOPI pot bearing said thrust material is made of the polymer-chemistry object from the surra SUTOPI pot bearing characterized by preparing the notching section in a periphery, and a radial hydrodynamic bearing.

[Claim 2] As opposed to a housing body, the sleeve section fixed to this housing, and said housing body relatively The Rota section which can rotate freely, The head concluded by said Rota section to a globular form shaft and this shaft end-face side A bottom plate, Have thrust material between said shafts and bottom plates, and it consists of said shaft and said sleeve section. It is the bearing of the compound die which has the radial hydrodynamic bearing which has a herringbone slot in either, the thrust material put on the bottom plate fixed to one side of said sleeve section, and the thrust pivot bearing which consists of ends of a shaft. Oil is filled up with the sleeve section and a superior lamella into the bearing which consisted of ******. In the disk driving gear which used the hydrodynamic bearing equipment of the compound die of the oil lubrication in which the oil makes generate the dynamic pressure of the bearing of a radial

direction, and the sliding section of the bearing of the thrust direction carries out lubrication Said thrust material intervenes between the spherical point of said shaft, and said superior lamella. The pinhole which is open for free passage on a sleeve section periphery from the field which concludes the bottom plate of the before [the surra SUTOPI pot bearing to which PIPOTTO bearing to which the head of a shaft slides on a thrust material top is made as for nothing and said thrust material from the high-polymer-chemistry object] sleeve section is prepared. The disk driving gear which between this pinhole and the pivot bearing sections established the slot in the sleeve section side, and used the hydrodynamic bearing equipment of the compound die of the oil lubrication which consists of thrust pivot bearing with a free passage with the pivot bearing section and a sleeve section periphery, and a radial hydrodynamic bearing.

[Claim 3] The disk driving gear which used the hydrodynamic bearing equipment of the compound die of the oil lubrication which consists of thrust pivot bearing with the thrust pivot bearing whose thrust material is a high molecular compound according to claim 1 or 2, and a radial hydrodynamic bearing.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the disk driving gear which used the hydrodynamic bearing equipment used for light, a magnetic disk drive, etc.

[0002]

[Description of the Prior Art] In recent years, light and a magnetic disk drive tend to progress to the formation of small lightweight, and high capacity-ization. the response to a miniaturization and thin-shape-izing also avoids a spindle motor with the spread of the personal computers of note size -- not having -- in addition -- and shock-proof improvement high-degree-of-accuracy-ization began to be demanded. Many ball bearing has been adopted as bearing conventionally used for a spindle motor. If small ball bearing is used with the formation of a small outer diameter of a spindle motor, sufficient rotational accuracy is not acquired, but implementation of high-capacity-izing will be difficult, and shock-proof ability will fall extremely, ball bearing will be degraded, and the noise problem will be generated.

[0003] Recently, in the rotational accuracy of ball bearing, I hear that high capacity-ization cannot be measured and the liquid bearing spindle motor of a hydrodynamic bearing which was full of the lubricating oil is beginning to be used. That whose bearing of the thrust direction is pivot bearing is proposed.

[0004] As this conventional kind of a revolution driving gear, there is a thing as

shown, for example in drawing 8 .

[0005] Hereafter, the conventional magnetic-disk driving gear is explained. Drawing 8 is the sectional view of the magneto-optic-disk driving gear which used the hydrodynamic bearing of an engagement condition for the conventional magneto-optic disk. The conventional example is explained referring to a drawing.

[0006] drawing 8 -- setting -- 201 -- a magneto-optic disk and 202 -- a disk hub and 203 -- a shaft and 204 -- the sleeve section and 205 -- a thrust plate and 206 -- a chucking magnet and 207 -- the shaft conclusion section and 208 -- the rotor hub section and 209 -- the Rota frame and 210 -- for a coil and 213, as for housing and 215, a printed circuit board and 214 are [a magnet and 211 / a stator core and 212 / the 1st radial dynamic pressure bearing and 216] the 2nd radial dynamic pressure bearing.

[0007] The rotor hub section 208 which positions by carrying a magneto-optic disk 201 in the shaft 203 which is engaged, positioning the center of rotation of a magneto-optic disk 201, and is rotated at a predetermined engine speed united with said magneto-optic disk 201 is concluded in the conclusion section 207 of a rotor hub. The chucking magnet 206 which carries out magnetic attraction of the disk hub 202 formed in the center section of the magneto-optic disk 201 by soft magnetism material, and is fixed to the rotor hub section 208 has fixed in the

rotor hub section 208. It is fixed to the Rota frame 209 of the shape of an abbreviation cup which forms in the rotor hub section 208 the magnetic path of the bell shape **** magnet 210 magnetized to the multi-electrode. The core of said Rota frame 209 is fixed with press fit, adhesion, caulking, etc., respectively, and the rotor hub section 208 and the chucking magnet 206 with which said shaft 203 supports said disk 201 in a magnet 210 and the top panel section at the inner circumference section constitute the Rota section as a whole in it.

[0008] In the outside of the internal body of housing 214, the stator core 211 by which the coil 212 was ****(ed) has fixed. The printed circuit board 213 in which the component thru/or printing patterns which drive a motor, such as IC, were mounted is fixed to housing 214. The sleeve section 204 is fixed inside [body] housing 214, and the thrust plate 205 is being fixed to the sleeve section 204.

[0009] As for the thrust direction, said Rota section is supported by the radial direction free [a revolution with the thrust plate 205] in the sleeve section 204.

[0010] A shaft 203 is inserted in the bore hole of the sleeve section 204 which has the 1st and 2nd bearings 215,216 which have a herringbone slot pivotable, and the Rota section is being fixed to the end of a shaft 203. Moreover, the thrust plate 205 formed in another edge of a shaft 203 and the edge of the sleeve section 204 constitutes thrust pivot bearing, and is supporting the thrust direction.

[0011] About the hydrodynamic bearing equipment constituted as mentioned

above, the actuation is explained below.

[0012] In a radial direction, if a shaft 203 rotates, in an operation of the herringbone slot established in the bearing 215,216 of the sleeve section 204, dynamic pressure is generated through oil, and a shaft 203 will surface and will be rotated by non-contact. In the thrust direction, they are the head of a shaft 203, and the pivot bearing of the metallic thrust plate 205. Since the thrust direction does not surface, a disk side does not have change in the height at the time of quiescence and a revolution.

[0013] Moreover, although the oil used for a liquid bearing is insulating oil, since the head and the thrust plate 205 of a shaft 203 are a metal, the magnetic disk and the equipment chassis are switch-on. Static electricity is charged to a magnetic disk and the potential difference seems therefore, not to be generated between a magnetic disk and the magnetic head by friction with a magnetic disk and air during a revolution of a magnetic disk.

[0014] Next, when sealing immobilization of the sleeve section 204 and the thrust plate 205 is carried out at caulking etc., the sleeve section 204 to which the thrust plate 205 was fixed is lubricated with oil, the shaft 203 is inserted to a setting-out location, but since a thrust section will be in a sealing condition, insertion takes time amount.

[0015]

[Problem(s) to be Solved by the Invention] However, when a shaft 203 rotates in the radial direction of an axial revolution mold with the above-mentioned conventional configuration, dynamic pressure is generated through oil in an operation of the herringbone slot established in bearing of the sleeve section 204, and since it rises to surface and rotates according to non-contact, it is reliable [a shaft 203]. Since it will rotate by non-contact equally if the radial direction is made of the hydrodynamic bearing also in the axial cover half, it is reliable. Since the thrust directions are the head of a shaft 203, and the pivot bearing of the metallic thrust plate 205, and the thrust direction does not surface, a disk side does not have change in the height at the time of quiescence and a revolution. However, wear occurs by the point of a shaft 203, and sliding of the thrust plate 205. The metal wear powder of the thrust plate 205 by the head of a shaft 203 entered into pivot bearing, and promoted wear, and while polluting the oil for which hydrodynamic bearing equipment is used, it had the trouble that dependability would be spoiled remarkably.

[0016] When sealing immobilization of the sleeve section 204 and the thrust plate 205 is carried out at caulking etc., the sleeve section 204 to which the thrust plate 205 was fixed is lubricated with oil. Since it is related to the amount in which air leaves the insertion speed of a shaft 203 through the clearance between a shaft 203 and the sleeve section 204 since air is sealed in the sleeve

section 204 in case a shaft 203 is inserted It had the trouble that inserting a shaft 203 to a setting-out location in the case of the narrow liquid bearing of a clearance took time amount.

[0017] This invention solves the above-mentioned conventional trouble, generating of the metal wear powder of a shaft 203 and the thrust plate 205 is prevented, contamination of the oil in a hydrodynamic bearing is prevented, and it aims at offering the disk driving gear which used the easy hydrodynamic bearing of assembly by the low cost in consideration of conductivity.

[0018]

[Means for Solving the Problem] It is the radial bearing which the hydrodynamic bearing equipment used for the disk driving gear of this invention in order to attain this object consists of a shaft and the sleeve section, and has a herringbone slot in either, and a thrust directional-axis carrier is pivot bearing. In the oil lubrication hydrodynamic bearing equipment which has a radial hydrodynamic bearing and thrust pivot bearing, the thrust bearing is carrying out the following configuration.

(1) The head of a shaft supports through the thrust material of resin to a metal plate, and as the wear powder generated by the head of a shaft and sliding of the thrust material of resin is not a metal, it aims at improvement in dependability.

(2) Give conductivity to the resin used for thrust material.

(3) Use the polyacetal resin which was excellent in the lubricity of thrust material. Or heat-resistant excellent polyimide resin is used.

(4) It is [0019] to the radius of curvature r of R configuration at the head of a shaft 203, and the diameter d of a shaft 203 because of the wear-resistant improvement in the resin of thrust material.

[Equation 1]

$10d > r > 1.5 \times d/2$

[0020] It constitutes in ******.

(5) There is a configuration which enlarged the bore of the sleeve section so that the junction profile section of R configuration at the head of a shaft and the path periphery section may not start herringbone bearing.

(6) Constitute the notching section on the periphery of a bottom plate.

(7) Prepare the pinhole which is open for free passage on the periphery of the sleeve section from the field which concludes the bottom plate of the sleeve section, and between the pinhole and pivot bearing section establishes a slot in a sleeve section side, and make it the configuration which has a free passage with the periphery of the pivot bearing section and the sleeve section.

[0021] By these configurations, since it is the pivot bearing which minded the thrust material made of resin between the head of a shaft, and the metallic thrust

plate, wear occurs by the point of a shaft, and sliding of thrust material, and since the thrust direction is not metal wear powder, it enters into pivot bearing and does not promote wear. If the ingredient which excelled [material / thrust] in sliding nature, and the heat-resistant outstanding ingredient are used, dependability will improve further.

[0022] If conductive thrust material is used, the head of a shaft will be in an equipment chassis and switch-on through thrust material.

[0023] Since air escapes through the pinhole and clearance which were open for free passage besides the sleeve section to sleeve circles in case the sleeve section to which the thrust plate was fixed is lubricated with oil and a shaft is inserted when the sleeve section and a metal plate are fixed to caulking etc., a shaft can be easily inserted to a setting-out location.

[0024]

[Example] (Example 1) The 1st example of this invention is explained below, referring to a drawing.

[0025] Drawing 1 is the sectional view of the magneto-optic-disk driving gear which used the hydrodynamic bearing of an engagement condition for the magneto-optic disk in the 1st example of this invention. Drawing 2 is the amplification explanatory view of the pivot bearing section in the 1st example of this invention.

[0026] In drawing 1 and drawing 2 1 a disk hub and 3 for a magneto-optic disk and 2 A shaft, In 4, the sleeve section and 5 a chucking magnet and 7 for a bottom plate and 6 Thrust material, In 8, a rotor hub and 9 a magnet and 11 for the Rota frame and 10 A stator core, In 12, a coil and 13 housing and 15 for a printed circuit board and 14 The 1st body, For the 2nd body and 17, as for the shaft conclusion section of the rotor hub section 8 of Rota, and 19, the space section and 18 are [16 / the 3rd body and 20] the intersection profile sections of the head R configuration of a shaft 3, and the periphery section of a shaft 3.

[0027] The rotor hub section 8 of Rota which carries a magneto-optic disk 1 in the shaft 3 which is engaged, positioning the center of rotation of a magneto-optic disk 1, and is rotated at a predetermined engine speed united with said magneto-optic disk 1, and positions the height direction is concluded in the shaft conclusion section 18. The chucking magnet 6 which carries out magnetic attraction of the disk hub 2 formed in the center section of the magneto-optic disk 1 by soft magnetism material, and is fixed to the rotor hub section 8 of Rota has fixed in the rotor hub section 8 of Rota. The Rota frame 9 of the shape of an abbreviation cup which forms the magnetic path of the bell shape magnet 10 magnetized to the multi-electrode is being fixed to the rotor hub section 8 of Rota. The rotor hub section 8 and the chucking magnet 6 of Rota with which said shaft 3 supports said disk in a magnet 10 and the top panel

section at the inner circumference section are being fixed to the core of said Rota frame 9 with press fit, adhesion, caulking, etc., respectively.

[0028] In the outside of the internal body of housing 14, the stator core 11 by which the coil 12 was ****(ed) has fixed. The printed circuit board 13 in which the component thru/or printing patterns which drive a motor, such as IC, were mounted is fixed to housing 14. The sleeve section 4 is fixed inside [body] housing 14, a bottom plate 5 is fixed to the sleeve section 4, the thrust direction is supported with a bottom plate 5 through the thrust material 7, and the head of a shaft 3 constitutes the pivot bearing to which the head of a shaft 3 slides on the thrust material 7 top.

[0029] A shaft 3 is inserted in the bore hole of the sleeve section 4 which has the 1st and 2nd bodies 15 and 16 which have a herringbone slot in a bore pivotable, and the rotor hub is being fixed to the end of a shaft 3.

[0030] The big space section 17 of a path is constituted between the 1st body 15 and the 2nd body 16, and the 3rd body 19 with a bigger path than said bodies 15 and 16 is further formed in the thrust bearing section side of the sleeve section 4.

[0031] The actuation is explained below, referring to a drawing about the hydrodynamic bearing equipment constituted as mentioned above.

[0032] If a shaft 3 rotates, dynamic pressure is generated through oil in an operation of the herringbone slot established in the bodies 15 and 16 of the

sleeve section 4, and a shaft 3 will surface and will be rotated by non-contact. The thrust direction is blockaded with the sleeve section 4 and a bottom plate 5. The thrust material 7 of polymeric materials is between the heads of the bottom plate 5 and shaft 3, and a shaft 3 slides on said thrust material 7 top. When long duration operation is carried out, although the thrust material 7 is worn out, some wear powder may come the head R section of a shaft 3 to the intersection profile section 20 with the periphery section of a shaft 3 as ****. The intersection profile section 20 has not started the 2nd body 16, and since the 3rd body 19 is located, since wear powder does not go to the bearing of a herringbone slot, it can secure the life of a motor. Therefore, it is made for the intersection profile section 20 of a shaft to have not started the configuration of radial bearing in a dynamic pressure liquid bearing with pivot bearing (refer to drawing 2).

[0033] Moreover, it is [0034], when distance to the intersection profile section 20 of a shaft and the 2nd body 16 of the nearest radial bearing is set to x and the clearance between a shaft 3 and the bore section of the 3rd body 19 is set to deltag.

[Equation 2]

$$\Delta g > x$$

[0035] By making it ******, the wear powder generated from thrust bearing has

prevented going into the narrow radial bearing of a clearance.

[0036] Moreover, when the radius of curvature of the head R configuration of a shaft 3 is set to r, the maximum planar pressure Pmax and friction Tp torque are

[0037].

[Equation 3]

$$Pmax = a \times r^{\wedge} (-2/3)$$
$$Tp = b \times r^{\wedge} (1/3)$$

[0038] It comes out and asks.

It corrects. As for a, the relation of each ratio of the maximum planar pressure to which the multiplier b set the maximum planar pressure Pmax and friction torque Tp of a case of the multiplier **** radius of curvature r0 to 1, and friction torque is shown in drawing 3 . Since planar pressure will become large although friction torque falls if the radius of curvature r at the head of a shaft 3 is made small, when the thrust material 7 is resin, making [many / not much] planar pressure may spoil dependability on the contrary. Moreover, since friction torque may increase, the loss torque may serve as heat, temperature may rise and dependability may be spoiled although planar pressure falls when radius of curvature r is enlarged, the design of pivot bearing is carried out so that the relation between the radius of curvature r at the head of the shaft 3 of thrust bearing and the diameter d of a shaft 3 in (several 1) may become.

[0039] The thrust material 7 is common polymeric materials. However, by the portable type, in order to reduce friction torque over a long period of time, resin selection which uses lubricative outstanding polyacetal resin for the thrust material 7 is carried out. When there are many activities in the time of an elevated temperature, activity selection of the heat-resistant excellent polyimide resin is carried out.

[0040] Moreover, by carrying out relation between the outer diameter D of the thrust material 7, and the diameter d of a shaft 3 like D>d, since the thrust material 7 does not fall out from the sleeve section 4 at the time of insertion of a shaft 3, an activity is stabilized. Although the thrust material 7 is stuck to a bottom plate 5 and it does not move for oil even if a shaft 3 moves in the thrust direction, it may move in the direction of a field and it may be necessary to regulate a motion. By making it the relation of D>d, a touch area increases, and it is hard to move upwards, and can also regulate with the path of the 3rd body 19. Before attaching a bottom plate 5, the bearing of the relation of D>d can be constituted by putting the thrust material 7 into the sleeve section 4, and assembling it.

[0041] (Example 2) Drawing 4 is the sectional view of the magnetic-disk driving gear which used the hydrodynamic bearing in the 2nd example of this invention.

[0042] In drawing 4 31 the sleeve section and 33 for a shaft and 32 Housing, In

34, the rotor hub section and 35 a bottom plate and 37 for a magnet and 36 A stator core, 38 thrust material and 40 for a coil and 39 The flange of housing 33, 41 -- the internal body of housing 33, and 42 -- a disk receptacle side and 43 -- for the 2nd body and 46, as for the 3rd body and 48, the space section and 47 are [a disk inside-diameter-calibration body and 44 / the 1st body and 45 / a hole and 49] the free passage sections between the 3rd body 47 and a hole 48.

[0043] The housing 33 of a motor has the configuration of a flange 40, the internal body 41, and an external body, and the periphery of the flange 40 of housing 33 is attached in the chassis of HDD equipment. The sleeve section 32 is attached inside said internal body 41. To the peripheral face of the internal body 41 of housing 33, the stator core 37 by which the coil 38 was ****(ed) has fixed. The rotor hub section 34 is carrying out the cup configuration which consists of a disk receptacle side 42 and a disk inside-diameter-calibration body 43. To the body inner circumference of said rotor hub section 34, the magnet 35 of the shape of a cylinder which magnetized N pole and the south pole by turns to the hoop direction has fixed. Said shaft 31 is fixed to the core of said rotor hub section 34, a magnet 35 is fixed to the inner circumference section, and the Rota section is constituted as a whole.

[0044] A shaft 31 is inserted in the bore hole of the sleeve section 32 which has the 1st and 2nd bodies 44 and 45 which have a herringbone slot in a bore

pivotable, and constitutes the dynamic pressure liquid bearing of a radial. Moreover, one edge of a shaft 31 is carrying out R configuration, makes the thrust material 39 of polymeric materials intervene between a bottom plate 36 and the head of a shaft 31, and constitutes the pivot bearing of the head of a shaft 31, and the thrust material 39.

[0045] The big space section 46 of a path constitutes between the 1st body 44 and the 2nd body 45, the 3rd body 47 with a bigger path than bodies 44 and 45 is further formed in the thrust bearing side of the sleeve section 32, and it is placed between the minute gaps of said 1st and 2nd bodies 44 and 45 and shaft 31 by oil.

[0046] The hole 48 small in the sleeve section 32 is open between the exterior of the sleeve section 32, and the interior, and the 3rd body 47 and hole 48 lead in the free passage section 49 further.

[0047] The actuation is explained below, referring to a drawing about the hydrodynamic bearing equipment constituted as mentioned above.

[0048] A magnetic disk (not shown) is carried in the disk receptacle side 42 of the rotor hub section 34. The motor possessing said Rota section and said housing 33 is a radial type brushless motor, a current energizes in a coil 38, a field occurs in the salient pole of a stator core 37, and generates torque between the magnets 35 for fields which countered the stator core 37, and rotates the

Rota section. Therefore, the magnetic disk clamped in the rotor hub section 34 also rotates with the revolution of the Rota section.

[0049] If a shaft 31 rotates, dynamic pressure is generated through oil in an operation of the herringbone slot established in the bodies 44 and 45 of the sleeve section 32, and a shaft 31 will surface and will be rotated by non-contact. Moreover, the head of a shaft 31 slides on the thrust material 39 top in the thrust direction.

[0050] The thrust material 39 is conductive polymeric materials. Therefore, since the head and the thrust material 39 of a shaft 31 will be in a conductive state, the magnetic disk and the equipment chassis are a conductive state. Static electricity is charged to a magnetic disk and the potential difference seems therefore, not to be generated between a magnetic disk and the magnetic head by friction with a magnetic disk and air during a revolution of a magnetic disk.

[0051] Since close leaves the air which was through the free passage section 49 and a hole 48 in the sleeve section 32 in case the sleeve section 32 to which the bottom plate 36 was fixed is lubricated with oil and a shaft 31 is inserted, when sealing immobilization of the sleeve section 32 and the bottom plate 36 is carried out at caulking etc., in the case of the narrow liquid bearing of a clearance, it can perform easily inserting a shaft 31 to a setting-out location.

[0052] (Example 3) The 3rd example of this invention is explained below,

referring to a drawing.

[0053] The expanded sectional view of thrust pivot bearing [in / in drawing 5 (a) / the 3rd example of this invention] and drawing 5 (b) are the perspective views of the bottom plate which has the notching section in the periphery section in the 3rd example of this invention.

[0054] In drawing 5 (a) and drawing 5 (b), the notching section by which thrust material and 54 were prepared in the bottom plate, and 55 was prepared [51 / a shaft and 52] for the sleeve section and 53 in the periphery section of a bottom plate 54, and 56 are the bodies of the sleeve section 52 in which the herringbone slot was established.

[0055] Some bottom plates 54 have the notching section 55, and caulking immobilization is carried out for the bottom plate 54 to the sleeve section 52. The sleeve section 52 interior and the exterior carry out aeration with a clearance in the place of the notching section 55. Moreover, if the field of the bottom plate 54 in contact with the sleeve section 52 of the place of the notching section 55 is small set up even if it is the structure sealed with the sleeve section 52 and a bottom plate 54, the micro clearance between the field can act as drawing, and the interior of the sleeve section 52, the exterior, and a free passage can be maintained.

[0056] Therefore, when sealing immobilization of the sleeve section 52 and the

bottom plate 54 is carried out at caulking etc., the place of the notching section 55 of a bottom plate 54 is open for free passage with the exterior. In case the sleeve section 52 is lubricated with oil and a shaft 51 is inserted, since the air which was in close in the sleeve section 52 becomes less enough [oil] as, as for the body 56 and shaft 51 of the sleeve section 52, a free passage with the exterior leaves it from the free passage section of the notching section 55 to the exterior in it. Therefore, in the case of the narrow liquid bearing of a clearance, it can perform easily inserting a shaft 51 to a setting-out location.

[0057] (Example 4) The 4th example of this invention is explained below, referring to a drawing.

[0058] Drawing 6 is the sectional view of the magnetic-disk driving gear which used the hydrodynamic bearing in the 4th example of this invention. Drawing 7 is the enlarged drawing of the thrust pivot bearing section in the 4th example of this invention.

[0059] In drawing 6 and drawing 7 61 the sleeve section and 63 for a shaft and 62 Housing, In 64, the rotor hub section and 65 a superior lamella and 67 for a magnet and 66 A stator core, 68 the internal body of housing 63, and 70 for a coil and 69 The 1st body, For the space section and 73, as for the 3rd body and 75, the shaft conclusion section of housing 63 and 74 are [71 / the 2nd body and 72 / thrust material and 76] the intersection profile sections of the head R

configuration of a shaft 61, and the periphery section of a shaft 61.

[0060] As shown in drawing 6 , the stator core 67 by which the coil 68 was ****(ed) by the peripheral face of the internal body 69 of housing 63 fixes, and the shaft 61 is being fixed to the shaft conclusion section 73 inside the internal body 69 of housing 63.

[0061] the rotor hub section 64 -- said shaft 61 -- a revolution -- free -- support -- now, it is. The sleeve section 62 specifically fixed to the rotor hub section 64 is supported through a hydrodynamic bearing device, a minute clearance exists in the sleeve section 62 and a shaft 61, and the head of a shaft 61 serves as pivot bearing which slides on the thrust material 75 through the thrust material 75 of polymeric materials between the superior lamella 66 with which there is oil in the clearance and the thrust direction was attached in the Rota side of the sleeve section 62, and the radii section of the end face of a shaft 61.

[0062] The bore hole of the sleeve section 62 which has a herringbone slot in the outer diameter of a shaft 61, and has the 1st and 2nd bodies 70 and 71 in the location which counters the slot is inserted by the shaft 61 pivotable. The big space section 72 of a path is constituted between the 1st body 70 and the 2nd body 71, the 3rd bigger body 74 than bodies 70 and 71 is further formed in the thrust bearing side of the sleeve section 62, and it is placed between the minute gaps of said 1st and 2nd bodies 70 and 71 and shaft 61 by oil. Moreover, there is

oil also in a thrust bearing side.

[0063] The hydrodynamic bearing equipment constituted as mentioned above is explained including the actuation below, referring to a drawing.

[0064] If the sleeve section 62 rotates to a shaft 61, dynamic pressure is generated through oil in an operation of the shaft 61 side herringbone slot prepared in the bodies 70 and 71 of the sleeve section 62, and the sleeve section 62 will surface and will rotate by non-contact.

[0065] If the sleeve section 62 rotates to a shaft 61, dynamic pressure will be generated through oil in an operation of the herringbone slot established in the bodies 70 and 71, it will rise to surface to a shaft 61, and the Rota section will rotate by non-contact. The thrust direction is blockaded with the sleeve section 62 and a superior lamella 66. The thrust material 75 of polymeric materials is between the superior lamella 66 and head of a shaft 61, and the thrust material 75 slides on the head of a shaft 61. When long duration operation is carried out, although the thrust material 75 is worn out, some wear powder may come the head R section of a shaft 61 to the intersection profile section 76 with the periphery section of a shaft 61 as ****. Since the intersection profile section 76 has not started the 2nd body 71 and it is located in the 3rd body 74 If distance to the 2nd body 71 of the intersection profile section 76 of a shaft and the nearest radial bearing is furthermore set to x and the clearance between a shaft 61 and

the bore section of the 3rd body 74 is set to deltag By making it the relation of (several 2), since the wear powder generated from thrust bearing does not go to the narrow radial bearing of a clearance, the life of a motor is securable. Therefore, it is made for the intersection profile section 76 of a shaft to have not started the configuration of radial bearing in a dynamic pressure liquid bearing with pivot bearing (refer to drawing 7).

[0066] Since planar pressure will become large although friction torque falls if the radius of curvature r at the head of a shaft 61 is made small, when the thrust material 75 is resin, making [many / not much] planar pressure may spoil dependability on the contrary. Moreover, since friction torque may increase, the loss torque may serve as heat, temperature may rise and planar pressure may spoil dependability although it falls when radius of curvature r is enlarged, the design of pivot bearing is carried out so that the relation between the radius of curvature r at the head of the shaft 61 of thrust bearing and the diameter d of a shaft 61 in (several 1) may become.

[0067] By using the thrust material 75 as conductive polymeric materials, since the head and the thrust material 75 of a shaft 61 will be in a conductive state, a magnetic disk and an equipment chassis will be in a conductive state. Static electricity is charged to a magnetic disk and the potential difference seems therefore, not to be generated between a magnetic disk and the magnetic head

by friction with a magnetic disk and air during a revolution of a magnetic disk.

[0068] The thrust material 75 is common polymeric materials. However, by the portable type, in order to reduce friction torque over a long period of time, resin selection which uses lubricative outstanding polyacetal resin for the thrust material 75 is carried out. When there are many activities in the time of an elevated temperature, heat-resistant excellent polyimide resin is used.

[0069] Moreover, as shown in (several 2), when the relation between the outer diameter D of the thrust material 75 and the diameter d of a shaft 61 carries out, since the thrust material 75 does not fall out from the sleeve section 62 at the time of insertion of a shaft 61, an activity is stabilized. Although the thrust material 75 is stuck to a superior lamella 66 and it does not move for oil even if a shaft 61 moves in the thrust direction, it may move in the direction of a field, a touch area increases, and it is hard to move upwards, and can also regulate with the path of the 3rd body 74. Before attaching a superior lamella 66, the bearing of the relation of D>d can be constituted by putting the thrust material 75 into the sleeve section 62, and assembling it.

[0070]

[Effect of the Invention] The hydrodynamic bearing equipment by this invention has the following effectiveness as mentioned above.

[0071] Since it is the pivot bearing which minded the thrust material made of

resin between the head of a shaft, and the metallic plate, wear occurs by sliding of a shaft point and thrust material, and since the thrust direction is not metal wear powder, it enters into pivot bearing and does not promote wear. If the ingredient which excelled [material / thrust] in sliding nature, and the heat-resistant outstanding ingredient are used, dependability will improve further.

[0072] Since air escapes through the pinhole and clearance which were open for free passage besides the sleeve section to sleeve circles in case the sleeve section to which the metal plate was fixed is lubricated with oil and a shaft is inserted when the sleeve section and a metal plate are fixed to caulking etc., a shaft can be easily inserted to a setting-out location.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view of the magneto-optic-disk driving gear which used the hydrodynamic bearing in the condition that the magneto-optic disk in the 1st example of this invention was engaged

[Drawing 2] The amplification explanatory view of the pivot bearing section of the magneto-optic-disk driving gear in the 1st example of this invention

[Drawing 3] The maximum planar pressure, ratio relation drawing of friction torque to the radius ratio in the 1st example of this invention

[Drawing 4] The sectional view of the magnetic-disk driving gear which used the hydrodynamic bearing in the 2nd example of this invention

[Drawing 5] (a) The expanded sectional view of the pivot bearing section in the 3rd example of this invention

(b) The perspective view of the bottom plate in the 3rd example of this invention

[Drawing 6] The sectional view of the magnetic-disk driving gear which used the hydrodynamic bearing in the 4th example of this invention

[Drawing 7] The amplification explanatory view of the pivot bearing section in the 4th example of this invention

[Drawing 8] The sectional view of the magneto-optic-disk driving gear which used the hydrodynamic bearing in the condition that the former carried out magneto-optic-disk engagement

[Description of Notations]

1,201 Magneto-optic disk

2,202 Disk hub

3, 31, 51, 61,203 Shaft

4, 32, 52, 62,204 Sleeve section

5 36,154 Bottom plate

6,206 Chucking magnet

7, 39, 53, 75 Thrust material

8, 34, 64,208 Rotor hub section

9,209 Rota frame

10, 35, 65,210 Magnet

11, 37, 67,211 Stator core

12, 38, 68,212 Coil

13,213 Printed circuit board

14, 33, 63,214 Housing

15, 44, 70 The 1st body

16, 45, 71 The 2nd body

17, 46, 72 Space section

18 73,207 Shaft conclusion section

19, 47, 74 The 3rd body

20 76 Intersection profile section

r Radius of curvature of R configuration at the head of a shaft

d The diameter of a shaft

x Distance from the intersection profile section to a radial bearing body

deltag Clearance between a shaft and the 3rd body

D The diameter of thrust material